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Date:
November 16, 2011

ARCADIS Project No.:
B0092351

Subject:

Proposed Modifications to Soil Analysis in the Sampling and Analysis Plan for Transformer Oil Release, 21690 Highway 299, Del Loma, California

On behalf of Pacific Gas and Electric Company (PG&E), ARCADIS U.S., Inc. (ARCADIS) prepared the Sampling and Analysis Plan for Transformer Oil Release, 21690 Highway 299, Del Loma, California, dated June 24, 2011 (SAP; ARCADIS 2011a) to collect multimedia samples (chicken, egg, soil and transformer oil) for analysis of polychlorinated biphenyls (PCBs). The United States Environmental Protection Agency (USEPA) Region 9 conditionally approved the SAP (ARCADIS 2011a) in a letter dated July 20, 2011, requesting only chicken and egg tissue sampling. Subsequently, on behalf of PG&E, ARCADIS prepared a Risk-Based Disposal Approval Application for Transformer Oil Release, dated September 2011 (Application; ARCADIS 2011b), summarizing results of the chicken, egg and transformer oil sampling for PCBs and the potential human health risks associated with chicken meat and egg consumption.

In a conference call hosted by the USEPA on October 19, 2011 and attended by the USEPA, PG&E and ARCADIS, the USEPA requested that additional soil analysis be performed. This memo proposes the following changes to the soil analysis outlined in the SAP (ARCADIS 2011a) in response to USEPA's request:

1. Obtain additional analytical data from soil samples collected previously, as identified in Table 1 below (as modified from Table 2 of the SAP) and in accordance with the procedures described in Section 6 of the SAP (ARCADIS 2011a). Analyze all proposed soil samples for PCB congeners and Aroclors by USEPA Method 1668C.

Table 1 Proposed Soil Analysis

Proposed Sample	Analyses	Analyses
	PCB Congeners (USEPA Method 1668C)	PCB Aroclors (in conjunction with USEPA Method 1668C)
Nine excavation confirmation soil samples ¹ (A1 - A4, A10 - A13, A18)	X	X
Four soil samples from outside the excavation area ¹ (B4, B9, B14, B19)	X	X

Notes:

¹ PG&E collected these soil samples on May 13 and 18, 2011 during the release response activities. Soil sample IDs/locations indicated in parentheses are identified in the results summary table and Site Plan prepared by PG&E and presented in Appendix A of the SAP (ARCADIS 2011a).

2. The sample results will be validated using USEPA Level III review, per the *National Functional Guidelines* (USEPA 2008) with consideration to the *National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA 2005). The same laboratory quality control criteria that were applied to the tissue samples will be applied to the soil analyses. The difference between a Level III and Level IV laboratory report is associated with the amount of detail in the supporting information. The USEPA Level III data package will include the following:
 - Case narrative referencing or discussing analytical procedures and any difficulties that were encountered, including deviation from Standard Operating Procedures and the Quality Assurance Project Plan; a Corrective Action Report, if necessary.
 - Chain of custody form
 - Analytical data
 - Practical quantitation limits
 - Method detection limits (MDLs), upon request
 - Preparation and analytical methods
 - Field and lab IDs
 - Sampling and analyses dates
 - Analytical batch number
 - Method blank

- Laboratory control samples
 - Matrix spike and matrix spike duplicate summary
3. Update to Section 3.6 Project Data Quality Objectives, Specify Performance or Acceptance Criteria:

MDLs for the 209 PCB congener analytical method will be sufficiently low to achieve the objectives of the proposed soil analysis; that is, the resulting data will permit an evaluation of whether PCB congeners in the former release area are below levels that would pose an unacceptable risk based on the foraging chicken uptake/consumption pathway. ARCADIS has derived draft risk-based cleanup levels (RBCLs) for PCBs in soil (separate report transmitted with this memo), which consider the consumption of chicken and eggs as produced on this property by the landowner. These RBCLs are derived using the risk assessment model submitted previously to the USEPA as part of the Application (ARCADIS 2011b) in conjunction with a chicken uptake model from the *Air Toxics "Hot Spots" Program Risk Assessment Guidelines* (California Environmental Protection Agency [Cal-EPA] 2003). The uptake model uses feed-to-chicken transfer coefficients for chicken meat and eggs, as presented by the Cal-EPA guidance. The risk assessment portion of these calculations was revised based on comments from the USEPA during the October 19, 2011 meeting. Specifically, the input parameters included a higher-end value for egg consumption (85 grams, which is approximately one egg per day) and a high-end value for exposure duration (30 years). The lowest RBCLs resulting from these calculations are 5 milligrams per kilogram (mg/kg) for PCBs expressed as total Aroclors and 74 picograms per gram (pg/g) for PCBs expressed a TCDD-equivalent (TEQ) concentration. These RBCLs, with a particular focus on the value for TEQ, indicate that the MDLs or reporting limits for PCB congeners that will be attained with the USEPA Method 1668C analysis (0.2 pg/g) will be adequate for risk-based decision making.

A report documenting the derivation of the RBCLs for soil is transmitted with this memo.

PG&E would like to host a conference call with you to discuss and gain concurrence on the RBCLs and the proposed changes to the SAP for soils as described in this memorandum. Please contact Anne Conner at APB1@PG&E.com or 925.415.6381 at your earliest convenience. We will proceed with the sample analysis upon receipt of approval of this memorandum. We appreciate your attention to this matter and look forward to working with you.

References

ARCADIS U.S., Inc. 2011a. Sampling and Analysis Plan for Transformer Oil Release, 21690 Highway 299, Del Loma, California. Prepared for Pacific Gas & Electric, Chico, California. June 24.



ARCADIS U.S., Inc. 2011b. Risk-Based Disposal Approval Application for Transformer Oil Release, 21690 Highway 299, Del Loma, California. Prepared for Pacific Gas & Electric, Chico, California. September.

California Environmental Protection Agency (Cal-EPA). 2003. The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Oakland, California. August.

United States Environmental Protection Agency (USEPA). 2008. Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review EPA-540-R-08-01. June.

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Pacific Gas and Electric Company

**Risk-Based Cleanup Levels for
Soil Based on Consumption of
Home-Raised Chickens and Eggs**

November 16, 2011



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**Risk-Based Cleanup Levels for
Soil Based on Home-raised
Chickens and Eggs**

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1. Derivation of Risk-Based Cleanup Levels

On behalf of Pacific Gas and Electric Company (PG&E), ARCADIS derived draft risk-based cleanup levels (RBCLs) for polychlorinated biphenyls (PCBs) in soil as part of risk assessment activities for the property located at 21690 Highway 299, Del Loma, Trinity County, California (site) following a 0.5-gallon transformer oil release that occurred on May 8, 2011. ARCADIS developed the RBCLs using the risk assessment model submitted previously to the United States Environmental Protection Agency (USEPA) Region 9 (USEPA; 2011) as part of the Application for Risk-based Disposal Approval for Transformer Oil Release, dated September 2011 (Application; ARCADIS 2011), and in conjunction with a chicken uptake model from the Air Toxics Hot Spots Program Risk Assessment Guidelines (California Environmental Protection Agency [Cal-EPA] 2003). This model uses feed-to-chicken transfer coefficients for chicken meat and eggs, which estimates PCB concentrations in these media as a function of dietary (or soil) intake. Other exposure assumptions are the same as those used in the previous risk assessment model; however, two exposure assumption values have been revised based on comments from the USEPA during a conference call on October 19, 2011 with the USEPA, ARCADIS and PG&E. Specifically, higher-end values are used for egg consumption (85 grams per day) and exposure duration (30 years).

The development of RBCLs, as well as the human health risk assessment activities for the site, was prompted by the May 2011 release of PCB-containing transformer oil, which was remediated soon after the release was discovered. The RBCLs are intended to be applied to post-remediation conditions and potential residual PCBs, which may be present in soil following the cleanup of affected soils. This use of RBCLs differs from the intended purpose of the previous risk assessment which estimated potential risks based on *measured* PCB concentrations in chicken and eggs. Importantly, the RBCLs also provide a measure of the required detection limits for additional soil analysis, if the subsequent data are to be used in risk-based decision making.

Other considerations in the RBCL derivation included:

- RBCLs were derived on the basis of cancer as the endpoint with target risk levels of 10^{-5} and 10^{-6} .
- RBCLs based on potential non-cancer hazards are not presented because in all cases, these values were higher (less stringent) than those based on cancer.



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- RBCLs were calculated for consumption of eggs only, meat only, and both eggs and meat at consumption rates described below.
- RBCLs were calculated for PCBs, expressed as total Aroclors, and as 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) toxic equivalent (TEQ) concentrations.

The RBCLs developed for soil based on these three exposure conditions are summarized in Table 1. The lowest soil RBCLs resulting from these calculations are 5 milligrams per kilogram (mg/kg) based on total Aroclors and 74 picogram per gram (pg/g) based on TCDD TEQ at the 10^{-6} target risk level. The worksheet calculations for these values are provided in Appendix A; RBCL calculations for total Aroclors are shown in Tables A-1a and A-1b, and the RBCL calculations for TCDD TEQ in Tables A-2a and A-2b.

Table 1 RBCLs for Soil Based on Home-Produced Food Consumption

Exposure Pathway	RBCLs Total Aroclors		RBCLs TCDD TEQ	
	<i>Risk 10^{-6}</i>	<i>Risk 10^{-5}</i>	<i>Risk 10^{-6}</i>	<i>Risk 10^{-5}</i>
Egg Consumption	8 mg/kg	80 mg/kg	123 pg/g	1,230 pg/g
Chicken Consumption	15 mg/kg	148 mg/kg	228 pg/g	2,282 pg/g
Egg & Chicken Consumption	5 mg/kg	48 mg/kg	74 pg/g	740 pg/g

The RBCLs for soil are based on an assumed consumption of home-produced poultry meat and eggs from chickens foraging in PCB-affected soil (exclusively) for 30-year exposure duration. As part of the RBCLs development, chickens were assumed to spend 100 percent of their foraging time in the PCB-affected areas. Thus, the RBCLs would be applied site-wide and are applicable to residual PCB levels, which are assumed to remain at a constant concentration in soil throughout the exposure duration.

The remaining sections describe the specific methods and assumptions used in developing the RBCLs for soil.



1.1 Derivation of Risk-Based Concentrations for Eggs and Chicken

The first step in the soil RBCL derivation uses the same exposure algorithms that were presented to the USEPA as part of the Application (ARCADIS 2011). The same exposure factor values and model assumptions are used, with exceptions noted above regarding food consumption rates and exposure duration. These values are summarized in Table 2 below.

The risk assessment model was used to obtain risk-based concentrations (RBCs) for chicken fat and eggs, by back-calculating from a target risk level to the media concentration, as follows:

$$\text{RBC (egg or chicken)} = \text{Target Risk Level} / (\text{Intake Factor} \times \text{Cancer Slope Factor [CSF]})$$

Where:

RBC = risk-based concentration (in eggs or chicken meat)

Target Risk Level = incremental cancer risk (10^{-5} or 10^{-6})

Intake Factor = $\text{IR} \times \text{EF} \times \text{ED} / (\text{ATc} \times \text{BW})$ (see Table 2)

CSF = $2 \text{ (mg/kg-day)}^{-1}$ for total PCBs; $130,000 \text{ (mg/kg-day)}^{-1}$ for TCDD TEQ

RBCs were calculated at the 10^{-5} and 10^{-6} risk levels. However, because it is possible for the property owner to eat both eggs and chicken meat raised on the property, some RBC values were calculated based on a cumulative 10^{-5} and 10^{-6} risk for both exposure pathways. This was achieved by allocating the target risk to each of the two pathways based on the expected contribution of each pathway to the total risk. The previous ARCADIS risk assessment that was based on actual measured PCB concentrations in eggs and chicken (meat) found that egg consumption contributed about 60%, and meat consumption about 40% to the total PCB risk. Therefore, for the cumulative risk RBCs, the target risk level was simply adjusted to 6×10^{-7} and 4×10^{-7} for the egg and meat consumption pathways, respectively.



Table 2 Exposure Factor Values Used to Derive RBCs for Chicken and Eggs

Factor	Abbrev	Value	Units	Notes/Source
Ingestion Rate for Eggs	IR-egg	85	g/day	USEPA (2005); See text
Ingestion Rate for Chicken (meat)	IR-meat	46.2	g/day	USEPA (2005); See text
Exposure Frequency	EF	365	days/year	See Section 1.1.3
Exposure Duration	ED	30	years	USEPA (2002)
Averaging Time	ATc	25,550	days	Equal to 70 years; USEPA (1989)
Body Weight	BW	70	kg	Default value for adult; USEPA (1989)

Notes:

g/day = grams per day

kg = kilogram

N/A = not applicable

The toxicity values used to calculate the RBCs above are the same as those used previously for the risk assessment. The CSF of 2 (milligrams per kilogram per day [mg/kg-day])⁻¹ used for PCBs is the value recommended by the USEPA for high-risk and persistent PCB mixtures, which includes those found in food products. The CSF for PCBs expressed as TCDD TEQ is 130,000 (mg/kg-day)⁻¹, which is also the CSF for dioxin (2,3,7,8-TCDD) that forms the basis for the current regional screening level for dioxin.

1.1.1 Ingestion Rate, Eggs (IR-egg)

An ingestion rate for eggs of 85 grams per day (g/day) is based on the conservative assumption that each adult in the home eats one 3-ounce (85-gram) home-produced egg per day (USEPA 2005, Table 6-1). This is equivalent to 1.21 grams per kilogram per day (g/kg-day) for a 70 kg adult, which is near the 90th percentile value (1.30 g/kg-day) for adult ingestion of home-produced eggs, according to the USEPA (USEPA EFH 1997, Table 13-43, and same values presented in USEPA EFH 2011 Table 13-40). These values are based on extensive consumer surveys, which found that consumers typically consume approximately 4 egg servings per week. An alternative ingestion rate of home-produced eggs of 52.5 g/day is identified by the USEPA (2005; Table C-1-3). This value is based on a mean consumption rate of 0.75 g/kg-day, for farmers eating the eggs produced by their own flock. The more conservative ingestion rate of 85 g/day is used at the request of USEPA Region 9, to better represent a reasonable maximum exposure (RME) - like exposure scenario.



1.1.2 Ingestion Rate, Chicken Meat (IR-meat)

An ingestion rate for chicken meat of 46.2 g/day is based on the average daily values for home-produced poultry consumption (USEPA 2005, Table C-1-3). This ingestion rate for chicken meat accounts for 2.8 servings per week of home-produced poultry for adults. The current size and nature of the flock would not likely support the number of chickens needed on a regular basis to provide this level of consumption. The current flock is used for egg production, from which some chickens are periodically taken for their meat. Nonetheless, this generic consumption rate is applied to account for the possibility that the use of the flock for meat is expanded in the future, although this would represent a dramatic departure from current practices. The assumed chicken meat consumption rate of 46.2 g/day likely represents a conservative selection for this assessment because the small flock size does not support this consumption rate.

1.1.3 Exposure Frequency and Exposure Duration

The exposure duration (ED) represents the number of years during which the assumed exposure scenario could continue. An ED of 30 years is chosen as a high-end estimate of residential occupancy, representing the RME value used in screening analysis by the USEPA (2002). While, in general, people remain at the same residence for an average of 8 to 12 years (USEPA 2011), a higher-end estimate was chosen to be conservative, which is also based on the rural setting and farming activities of the specific resident/landowner of interest (at the Del Loma property).

Exposure frequency (EF) corresponds to the number of days in a year when contact with the chemical-containing media is expected to occur. Because the egg and chicken consumption rates used in this assessment are based on average daily rates, an EF value of 365 days per year is assumed.

1.2 Derivation of Risk-Based Cleanup Levels for Soil

RBCs for soil are calculated using the RBCs for eggs (RBC_{egg}) and chicken meat (RBC_{meat}) calculated above in conjunction with a Cal-EPA (2003) uptake model for chickens based on feed-to-chicken transfer coefficients for meat and eggs. The Cal-EPA model relates a chemical intake by a farm animal to the predicted concentration in milk, meat, or eggs, with the use of a transfer coefficient (Tco). For PCB intake by chickens, the model is:

$$[PCB]_{eggs \text{ or meat}} = PCB \text{ Intake (or daily dose)} \times Tco$$



The PCB dose is multiplied by a transfer coefficient (Tco) to yield an estimated concentration in meat or eggs. Because soil is the only media that is assumed to be contributing to PCB uptake by chickens, the PCB dose is simply the dose via soil ingestion, estimated as the PCB soil concentration multiplied by the assumed soil ingestion rate (IR-soil) for chickens. The Cal-EPA model is:

$$[\text{PCB}]_{\text{eggs or meat}} = C\text{-soil} \times \text{IR-soil (chicken)} \times \text{Tco}$$

Where:

C-soil : Soil concentration of PCB [input as the RBC] (ug/kg)

IR-soil: Ingestion rate of soil (by chickens) (kg/day)

An RBCL can be calculated in terms of the RBCs (for chicken or egg) using this same equation and inputs, but in the reverse direction, and setting the $[\text{PCB}]_{\text{egg or meat}}$ concentrations to the RBC values derived in the previous section for eggs and meat. as follows:

$$\text{RBCLsoil} = \text{RBC (mg/kg)} / [\text{IR-soil [kg/day]} \times \text{Tco}]$$

Thus, two additional exposure factor values (soil ingestion rate for chickens and Tco for soil-to-eggs and soil-to-meat for PCBs) are required for this calculation, and are described in the following sections.

1.2.1 Soil Ingestion Rate (IR-soil)

This exposure factor describes the amount of soil ingested by chickens while foraging. Cal-EPA (2003) recommends the use of soil ingestion rates derived based on feed consumption and grazing. A technical support document for the Cal-EPA (2003) guidance states that a reasonable soil ingestion rate for chickens is 0.002 kg/day. This value is described in greater detail in a previous technical support document (Cal-EPA 1992), which estimated the soil intake by chickens to be 2 percent of an average feed intake of 0.1 kg/day. This value is also consistent with the soil ingestion estimate of about 2 grams per day used by others (e.g., National Research Council [NRC, 1984]).

1.2.2 Transfer Coefficient

Cal-EPA (2003) recommends transfer coefficient (Tco) for PCBs of 0.05 day/kg (Table 5-3 of the Cal-EPA guidance), which is intended for the estimation of a meat or egg concentration based on the dietary intake of PCBs by chickens. Cal-EPA (2003) did not derive a Tco specifically for eggs, but recommends that the meat Tco be applied to eggs. This is based on a comparable fat content of chicken meat and eggs (7 to 14 percent). It is also consistent with the chicken feeding study conducted by Stephens et al. (1995), who found that the distribution to eggs was less than, but comparable to that of fat, following an ingested dose of polychlorinated dibenzodioxins/polychlorinated dibenzofurans (often used as surrogate compounds for evaluating PCB disposition). The uncertainty in the Tco value of 0.05 day/kg is discussed in the following section.

1.3 Uncertainty Analysis of Select Exposure Assumptions

This subsection describes the uncertainties in the assumptions related to exposure and uptake that could have a substantial influence on the resulting RBCLs. As discussed throughout this report, exposure factor values in general are intended to be conservative and are selected from the upper end of the distribution of possible values, to reflect an RME scenario. However, also consistent with USEPA guidance, upper-end values are used together with some values representative of a central tendency estimate, to avoid the type of upper-bound estimates of exposure that are above the range of possible exposures (USEPA 1989). As described above, the egg ingestion rate used in this assessment is more likely to represent the high end of consumption figures, while the consumption rate assumed for home produced poultry is chosen from values more representative of typical, average values.

The exposure assumptions with the greatest uncertainty are likely those relating to the uptake of PCBs by chickens (and eggs), or specifically, the transfer coefficients, Tco, for eggs and chicken (meat). This uncertainty is due to the fact that there are only a few studies that provide these data. The Tco value provided in Cal-EPA (2003) risk assessment guidance was used in this evaluation. However, it is acknowledged that this value and the studies from which they are derived may be updated. In fact, Cal-EPA has recently released a draft revised version of its risk assessment guidance (Cal-EPA, 2011), which provides revised Tco values for chicken eggs and meat. This guidance is in draft form and being made available for the purposes of public review and comment. Because of the draft and for-public-comment status, ARCADIS did not use the proposed revised Tco values. These new values will be considered, when they are finalized.



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Based on these new developments and information, the RBCLs derived in this report should be considered as interim values, which are primarily for the purpose of evaluating the adequacy of MDLs accompanying any further soil analysis at the Del Loma property. The RBCLs might need to be reviewed with respect to the pending changes in the Tco values before they are used as a basis for further cleanup efforts for site soils.



2. References

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Appendix A

RBCLs – Calculation Worksheets

Table A-1a. Risk Based Concentrations for Chicken Eggs and Meat based on Exposure Model for Farmer/Consumer at Del Loma Property: Total PCB Concentrations

$$\text{Intake (Dose)} = [\text{PCB}](\text{egg or chicken}) * \text{IR} * \text{EF} * \text{ED} / (\text{AT} * \text{BW})$$

Factor	Abbrev	Units	Consuming Meat or Eggs	Consuming Meat and Eggs	Notes/References
Eggs					
[PCB]egg	C-egg	pg/g egg	Value Adult	Value Adult	
Ingestion Rate, eggs	IR-egg	g/day	960	576	Concentration that yields 1E-06 risk level for eggs separately or eggs and meat combined.
Exposure Frequency	EF	days/year	85	85	Assume one 3-ounce (85 g) egg per day; near 90th %ile value for home-produced eggs (EPA EFH 1997)
Exposure Duration	ED	years	365	365	IR already accounts for 4.3 servings per week (HHRAP)
Averaging Time, noncancer	AT-nc	days	30	30	Residential Occupancy Period (High end) from EPA (2002)
Averaging Time, cancer	AT-c	days	10950	10950	ED x 365 days/year
Body Weight	BW	kg	25550	25550	
			70	70	
Average daily dose	ADD	pg/kg/d	1.17E+03	6.99E+02	
Average daily dose	ADD	mg/kg/d	1.17E-06	6.99E-07	
Reference Dose, Aroclor 1254	RfD	mg/kg-day	2.E-05	2.E-05	
Hazard Index	HI	unitless	0.06	0.03	
Lifetime avg daily dose	LADD	pg/kg/d	5.00E+02	3.00E+02	
Lifetime avg daily dose	LADD	mg/kg/d	5.00E-07	3.00E-07	
Cancer Slope Factor, PCBs	CSF	1/mg/kg-day	2	2	
Incremental Cancer Risk	Risk	unitless	1.0E-06	6.0E-07	Upper-bound value for "highest risk and persistence" category (USEPA 1996) Risk target for combined meat and egg consumption if 3/5 of 1E-06 (risk allocated to egg consumption)
Chicken					
[PCB]chicken fat	TR	pg/g fat	Adult	Adult	
[PCB]chicken meat	C-chkn	pg/g meat	24000	9600	Concentration that yields 1E-06 risk level for meat separately or for eggs and meat combined.
Ingestion Rate, chicken meat	IR-meat	g/day	1776	710	Assume chicken (meat only) is 7.4% fat; Table 13-55, EFH 1997
Exposure Frequency	EF	days/year	46.2	46.2	Average daily values for home-produced poultry consumption (EPA Reg 6 - HHRAP)
Exposure Duration	ED	years	365	365	IR already accounts for 2.8 servings per week (HHRAP)
Averaging Time, noncancer	ATnc	days	30	30	Residential Occupancy Period (High end) from EPA (2002)
Averaging Time, cancer	ATc	days	10950	10950	ED x 365 days/year
Body Weight	BW	kg	25550	25550	
			70	70	
Average daily dose	ADD	pg/kg/d	1.17E+03	4.69E+02	
Average daily dose	ADD	mg/kg/d	1.17E-06	4.69E-07	
Reference Dose, Aroclor 1254	RfD	mg/kg-day	2.E-05	2.E-05	
Hazard Index	HI	unitless	0.06	0.02	
Lifetime avg daily dose	LADD	pg/kg/d	5.02E+02	2.01E+02	
Lifetime avg daily dose	LADD	mg/kg/d	5.02E-07	2.01E-07	
Cancer Slope Factor, PCBs	CSF	1/mg/kg-day	2	2	
Incremental Cancer Risk	Risk	unitless	1.0E-06	4.0E-07	Upper-bound value for "highest risk and persistence" category (USEPA 1996) Risk target for combined meat and egg consumption is 2/5 of 1E-06 (risk allocated to meat consumption);
Sum of Pathway Cancer Risk			2.0E-06	1.0E-06	

Notes:

Exposure scenario focuses on an adult consumer; these risks were found to be higher overall than those for a child consumer.

Table A-1b. Risk-Based Cleanup Levels (RBCLs) for Total PCBs in Soil Based on Chicken and Egg Consumption Pathway Uptake Model from Cal-EPA (2003) Guidelines

Term	Risk Level		Units	Description	Source/Notes
	1.E-05 Value	1.E-06 Value			
Eggs					
[PCB] egg	0.006	0.0006	mg/kg (ppm)	Risk-Based Concentration for Eggs.	See Table A-1a Cal-EPA (1992, 2003) ¹ From Cal-EPA (2003; Table 5.3)
IR-soil	0.0024	0.0024	kg/day	Soil ingestion rate by foraging hen	
Tco (eggs)	0.05	0.05	d/kg	Transfer coefficient of PCBs from diet	
C-soil	48	4.8	mg/kg (ppm)	Risk-based soil concentration assuming consumption of both eggs and chicken meat.	
C-soil-alt	80	8.0	mg/kg (ppm)	Risk-based soil concentration assuming consumption of eggs.	
Chicken Meat					
[PCB] in meat	0.0071	0.0007	mg/kg (ppm)	Risk-Based Concentration for Chicken (meat)	See Table A-1a Cal-EPA (2003) ¹ From Cal-EPA (2003; Table 5.3)
IR-soil	0.0024	0.0024	kg/day	Soil ingestion rate by foraging hen	
Tco (meat)	0.05	0.05	d/kg	Transfer coefficient of PCBs from diet	
C-soil	59	5.9	mg/kg (ppm)	Risk-based soil concentration assuming consumption of both chicken meat and eggs.	
C-soil-alt	148	15	mg/kg (ppm)	Risk-based soil concentration assuming consumption of chicken meat.	

Notes:

¹ See text. Cal-EPA (2003) estimated soil ingestion by foraging chickens to be 2% of a total dietary intake of 0.1 kg/day.

Table A-2a. Risk Based Concentrations for Chicken Eggs and Meat based on Exposure Model for Farmer/Consumer at Del Loma Property: TEQ Concentrations

$$\text{Intake (Dose)} = [\text{PCB}](\text{egg or chicken}) * \text{IR} * \text{EF} * \text{ED} / (\text{AT} * \text{BW})$$

Factor	Abbrev	Units	Value Adult	Meat and Eggs	Notes/References
Eggs					
[PCB]egg	C-egg	pg/g egg	0.015	Adult	Concentration that yields 1E-06 risk level for eggs separately or for eggs and meat combined.
Ingestion Rate, eggs	IR-egg	g/day	85	85	Assume one 3-ounce (85 g) egg per day; near 90th %ile value for home-produced eggs (EPA EFH 1997)
Exposure Frequency	EF	days/year	365	365	IR already accounts for 4.3 servings per week (HHRAP)
Exposure Duration	ED	years	30	30	Residential Occupancy Period (High End) from EPA (2002)
Averaging Time, noncancer	AT-nc	days	10950	10950	ED x 365 days/year
Averaging Time, cancer	AT-c	days	25550	25550	
Body Weight	BW	kg	70	70	
Average daily dose	ADD	pg/kg/d	1.80E-02	1.08E-02	
Average daily dose	ADD	mg/kg/d	1.80E-11	1.08E-11	
Reference Dose, TCDD	RfD	mg/kg-day	N/A	N/A	
Hazard Index	HI	unitless	N/A	N/A	
Lifetime avg daily dose	LADD	pg/kg/d	7.70E-03	4.62E-03	
Lifetime avg daily dose	LADD	mg/kg/d	7.70E-12	4.62E-12	
Slope Factor, TCDD	CSF	1/mg/kg-day	130000	130000	
Incremental Cancer Risk	Risk	unitless	1.0E-06	6.0E-07	Risk target for combined meat and egg consumption if 3/5 of 1E-06 (risk allocated to egg consumption)
Chicken					
[PCB]chicken fat	TR	pg/g fat	0.37	0.15	Concentration that yields 1E-06 risk level for meat separately or for eggs and meat combined.
[PCB]chicken meat	C-meat	pg/g meat	0.027	0.011	Assume chicken (meat only) is 7.4% fat; Table 11-24, EFH 1997
Ingestion Rate, chicken meat	IR-meat	g/day	46.2	46.2	Average daily values for home-produced poultry consumption (EPA Reg 6 - HHRAP)
Exposure Frequency	EF	days/year	365	365	IR already accounts for 2.8 servings per week (HHRAP)
Exposure Duration	ED	years	30	30	Residential Occupancy Period (High end) from EPA (2002)
Averaging Time, noncancer	ATnc	days	10950	10950	ED x 365 days/year
Averaging Time, cancer	ATc	days	25550	25550	
Body Weight	BW	kg	70	70	
Average daily dose	ADD	pg/kg/d	1.81E-02	7.23E-03	
Average daily dose	ADD	mg/kg/d	1.81E-11	7.23E-12	
Reference Dose, TCDD	RfD	mg/kg-day	N/A	N/A	
Hazard Index	HI	unitless	N/A	N/A	
Lifetime avg daily dose	LADD	pg/kg/d	7.74E-03	3.10E-03	
Lifetime avg daily dose	LADD	mg/kg/d	7.74E-12	3.10E-12	
Slope Factor, TCDD	CSF	1/mg/kg-day	130000	130000	
Incremental Cancer Risk	Risk	unitless	1.0E-06	4.0E-07	Risk target for combined meat and egg consumption if 2/5 of 1E-06 (risk allocated to meat consumption)
Sum of Pathway Cancer Risk			2.0E-06	1.0E-06	

Notes:

Exposure scenario focuses on an adult consumer; these risks were found to be higher overall than those for a child consumer.

Table A-2b. Risk-Based Cleanup Levels (RBCLs) for PCBs (as TEQ) in Soil Based on Chicken and Egg Consumption Pathway
Uptake Model from Cal-EPA (2003) Guidelines

Term	Risk Level		Units	Description	Source/Notes
	1.E-05 Value	1.E-06 Value			
Eggs					
[PCB] egg	0.089	0.0089	pg/g (ppt)	Risk-Based Concentration for Eggs.	see Table A-2a Cal-EPA (1992, 2003) ¹ From Cal-EPA (2003; Table 5.3)
IR-soil	0.0024	0.0024	kg/day	Soil ingestion rate by foraging hen	
Tco (eggs)	0.05	0.05	d/kg	Transfer coefficient of PCBs from diet	
C-soil	740	74	pg/g (ppt)	Risk-based soil concentration assuming consumption of both eggs and chicken meat.	
C-soil-alt	1233	123	pg/g (ppt)	Risk-based soil concentration assuming consumption of eggs.	
Chicken Meat					
[PCB] in meat	0.110	0.011	pg/g (ppt)	Risk-Based Concentration for Chicken (meat)	see Table A-2a Cal-EPA (2003) ¹ From Cal-EPA (2003; Table 5.3)
IR-soil	0.0024	0.0024	kg/day	Soil ingestion rate by foraging hen	
Tco (meat)	0.05	0.05	d/kg	Transfer coefficient of PCBs from diet	
C-soil	913	91	pg/g (ppt)	Risk-based soil concentration assuming consumption of both chicken meat and eggs.	
C-soil-alt	2282	228	pg/g (ppt)	Risk-based soil concentration assuming consumption of chicken meat.	

Notes:

¹ See text. Cal-EPA (2003) estimated soil ingestion by foraging chickens to be 2% of a total dietary intake of 0.1 kg/day.